Chapter Seven: Confirmed and Potential Contamination Sites

Organic, inorganic, or biological pollutants derived from landfills and leaking underground storage tanks pose a serious threat to the integrity of clean water drinking supplies as well as rivers and estuaries. The intimate connection between ground water and surface water on the Cape compounds the difficulty of managing these point sources of pollution, as does the permeability and generally poor contaminant adsorption characteristics of the sand and gravel aquifer.

PROBLEM HISTORY

Waste Disposal Facilities

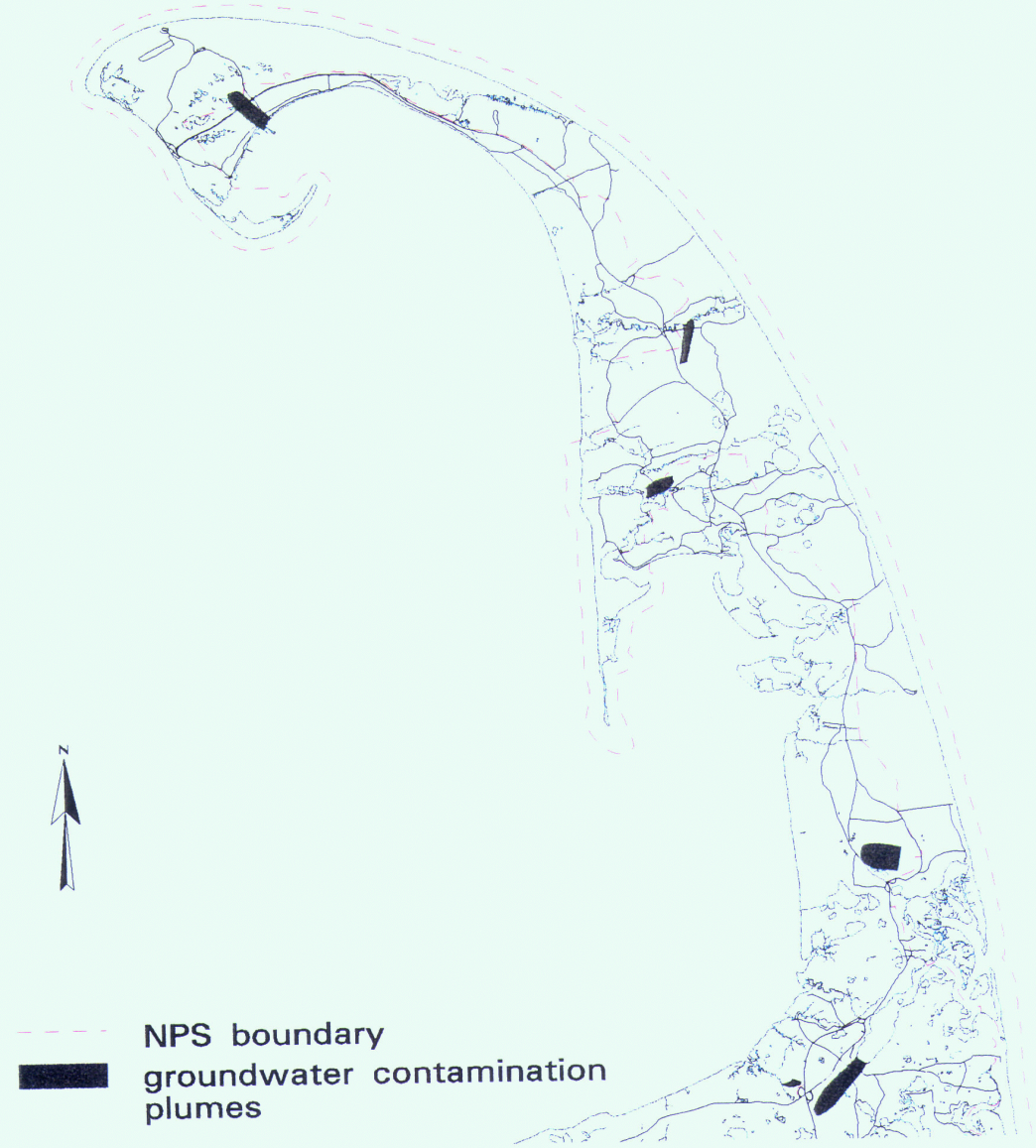
Landfills are among the five most serious threats to ground water quality in the United States (Noake, 1989). In Massachusetts, leachate contamination of ground water from landfills has been responsible for private well contamination in at least nine communities (Massachusetts Department of Environmental Quality Engineering, 1988). On the Cape, pollutants related to landfill leachate are also considered a threat to ground water supplies (Janik, 1987). A 1996 report (ATP Environmental, 1995) documents that the Eastham Municipal Landfill is directly responsible for contaminated private drinking water supplies within its vicinity.

Water that enters a landfill, usually in the form of rain and snow, comes into contact with buried wastes and forms leachate or dissolved waste. This leachate can contain toxic chemicals from commercial and household wastes. Often, the leachate leaves the landfill and follows the ground water flow, potentially entering recharge zones for water wells (Noake, 1989). Poorly contained landfills, such as unlined landfills in the sandy soils of the Cape, are especially vulnerable because water can infiltrate them from all sides, including underneath the waste (Massachusetts Department of Environmental Quality Engineering, 1988).

There are five landfills (now closed) located on the outer Cape (Figure 7.1), all of which have the potential to impact the surface water resources within the National Seashore (Table 7.1). The Provincetown and Truro landfills are located inside the National Seashore boundary. Wellfleet's landfill abuts the National Seashore boundary, and the two in Orleans and Eastham are in close proximity to the National Seashore. All landfills have been monitored by wells and the contaminant plume (Figures 7.2a-d), at each site mapped and discussed in various reports (Cambareri et al., 1989 a and b; Frolich, 1991; Urish et al., 1991; Urish et al., 1993; Winkler, 1994). According to these reports, some

Figure 7.1: General Location of Major Groundwater Contamination Plumes, Cape Cod National Seashore

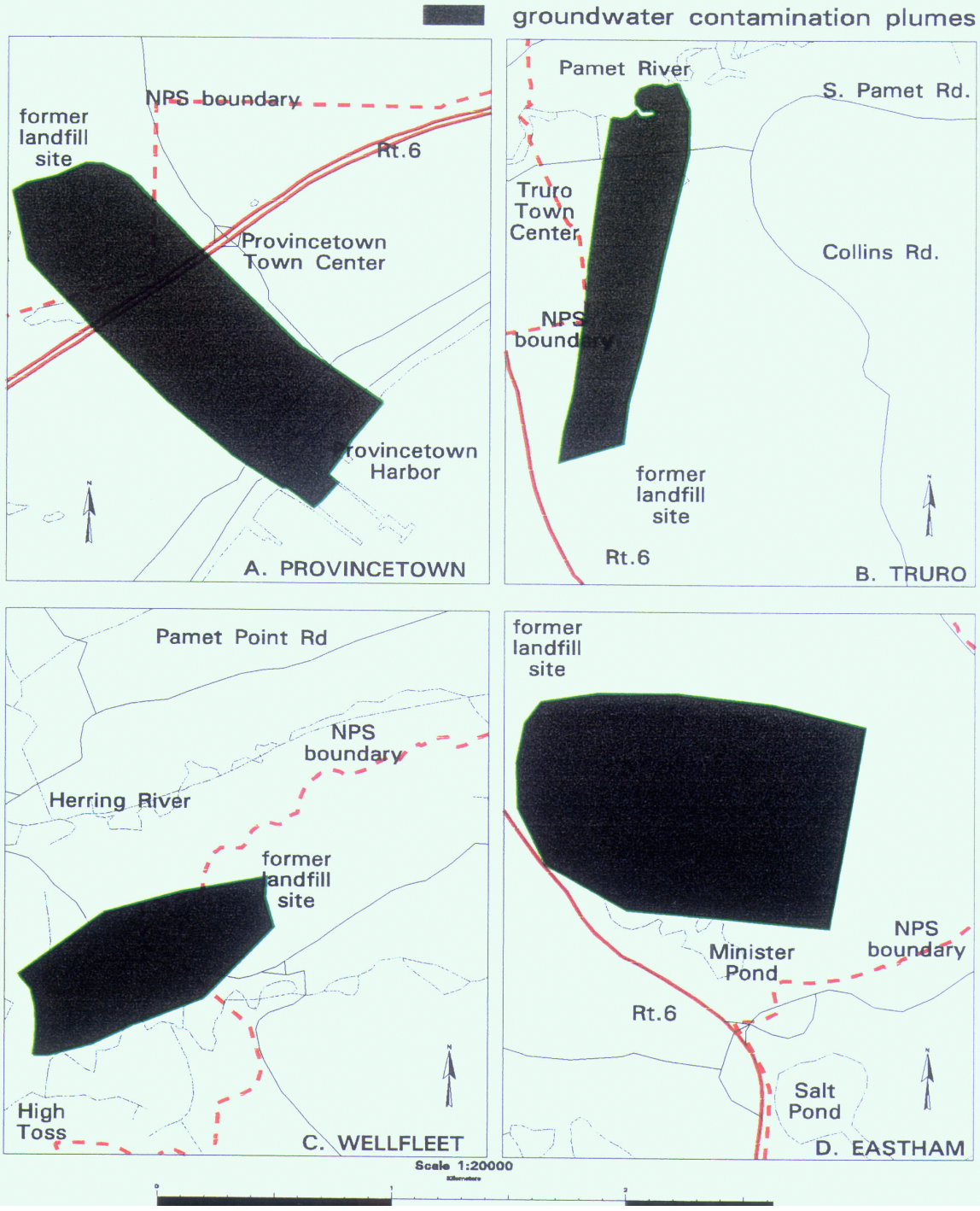
Source: Cape Cod Commission GIS program.



Water Resources Management Plan

Figure 7.2a-d: Major Groundwater Contamination Plumes Cape Cod National Seashore

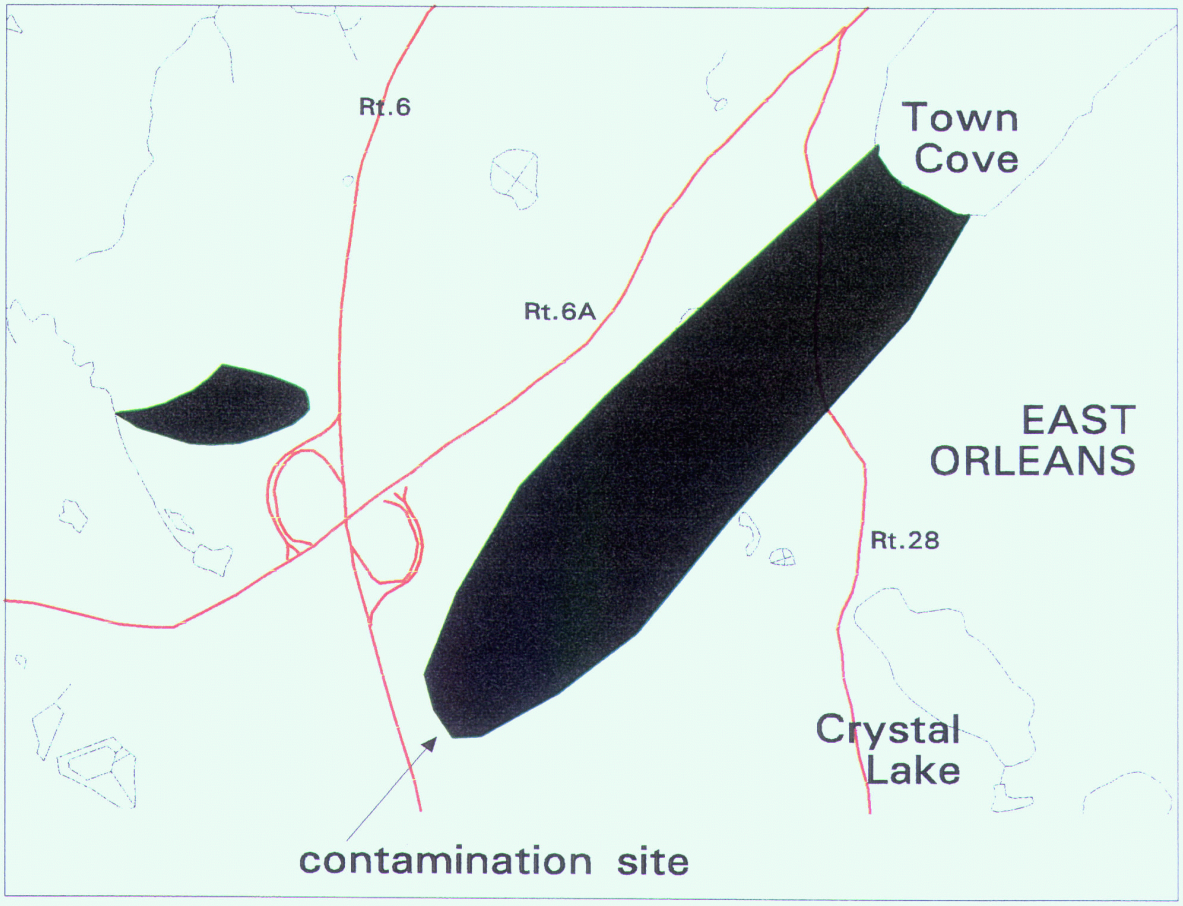
Source: Cape Cod Commission GIS data.



Water Resources Management Plan

Figure 7.2e: Major Groundwater Contamination Plumes Orleans - Cape Cod National Seashore

Source: Cape Cod Commission GIS program.



groundwater contamination plumes

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Scale 1:20000

map prepared 12/4/96 Mark Adams

Table 7.1. Status summary of landfills on outer Cape Cod.

Location	Status	Liner	Cap	Potential Impact Areas
Provincetown, within the Seashore	Inactive	No	Yes	Province Land Ponds Provincetown Harbor
Truro, within the Seashore	Inactive	No	No	Pamet River
Wellfleet	Inactive	No	No	Herring River
Orleans	Inactive	No	No	Nauset Marsh
Eastham	Inactive	No	No	Not Determined

surface waters both inside and outside of National Seashore boundaries may have been impacted.

The Provincetown landfill is located above the Pilgrim lens of the Cape Cod aquifer west of Race Point Road on a 25-acre site within the Cape Cod National Seashore. The landfill was in operation from 1954 to 1992 and officially closed in 1994 (Appleton, 1994). It currently serves as a recycling and composting facility. The landfill is capped; however, it is not lined. Located on the northeast corner of the landfill is a septage disposal facility that until 1991 allowed septage to infiltrate to the ground water (Urish et al., 1993). Wastewaters that once went to this lagoon are now collected by septage pumpers and sent to the Tri-Town Septage Facility in Orleans (SEA Consultants, 1994).

Water quality monitoring, initiated in 1985, has shown that wells lying south and southeast of the landfill and septage lagoon have been impacted with landfill leachate (Urish et al., 1993). Coliform bacteria has been consistently detected in ground water samples near the landfill. SEA Consultants Inc. (1994) attribute this to sample contamination or laboratory error as bacteria are thought to be quickly filtered in sandy soils. However, Harvey et al. (1989) have documented bacterial transport farther than 0.6 miles (1000 meters) in ground water that is also contaminated by organic chemicals. Organically rich ground water fuels high bacterial growth rates which overcome soil filtering and retardation effects. Chlorobenzene and other volatile organic compounds (VOC's) have been detected in several down gradient wells at concentrations ranging from 0.6 to 70.0 mg/l (SEA Consultants, 1992). The maximum concentration of chlorobenzene permitted in drinking water under Massachusetts regulation sis 0.1 mg/L; most VOCs have a maximum contaminant level of much less than 0.7 mg/L. Total xylenes have a limit of 10 mg/l (310

CMR Drinking Water, 1997). Levels of combustible gas exceeding explosive limits have also been detected in soil gas along the northwest edge of the landfill (SEA Consultants, 1992).

The flow path of the contamination plume has been mapped (Figure 7.2a). It is estimated that the plume moves from the landfill across Route 6 and continues southeasterly under a cemetery and residential area terminating in Provincetown Harbor (Urish et al., 1993). Ground water contaminated by this landfill's leachate exhibits high electrical conductivity, alkalinity, bicarbonate, ammonia, nitrate, orthophosphate, calcium, chemical oxygen demand, sulfate, chloride, metals, and volatile organic carbon compounds. Additional contaminants, including automotive contaminants, road salt, and on-site sewage disposal effluents, enter the water table and the landfill plume as it travels towards Provincetown Harbor (Urish et al., 1993). Travel time of contaminants from the Provincetown landfill to the harbor is estimated to be 10 to 30 years (Urish et al., 1993).

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Winkler (1994) concluded that the landfill and septic lagoon leachates are impacting surface waters to the west of the landfill as well. Two ponds that are adjacent to the landfill in the Province Lands, Duck and Bennett, showed increased nutrient levels and indications of eutrophication in recent sediments. However, it should be noted that SEA Consultants (1992), hired by Provincetown to monitor the landfill, has found no evidence that surface waters in either Bennett or Duck ponds are incurring impacts from landfill leachate.

The Truro landfill, also within the National Seashore, is located on the east side of Route 6, in southern Truro. The landfill sits over the Chequesset lens of the Cape Cod aquifer and was in operation for over 35 years. The landfill was closed in 1990, and all refuse has since been shipped off Cape to be incinerated at the SEMASS facility in Rochester, Mass. (East Cape Engineering, 1996). Although inactive, the landfill has not yet been capped. The latest proposal for capping this landfill was submitted to the Massachusetts Department of Environmental Protection on July 5, 1996 by East Cape Engineering. The septage lagoons at the landfill were closed in the early 1990s and the closure was approved by the Massachusetts Department of Environmental Protection (East Cape Engineering, 1996). Currently, septage from Truro is sent to Orleans for treatment. A landfill leachate plume, identified by increased specific conductance, alkalinity, pH, nitrate, sodium, iron, and VOC's, follows the ground water flow path north towards the Pamet River (Cambareri et al., 1989; Figure 7.2b). High nitrate levels at two monitoring wells indicate that there is a separate, shallower plume emanating from the septage lagoons. It is estimated that ground water migration from the Truro landfill to the Pamet River takes about 9 years and that contaminants from the landfill have been discharging into the Pamet River for at least the last two decades (Cambareri et al., 1989).

The Challenge

To formalize communication links with the Massachusetts Department of Environmental Protection and Cape towns regarding landfill plumes and hazardous releases from underground storage tanks. Monitor the effects of nearby landfills on natural resources of Cape Cod National Seashore.

The Wellfleet sanitary landfill, located above the Chequesset lens of the Cape Cod aquifer and off of Coles Neck Road, occupies 8.22 acres, 5.3 of which are used for the landfill itself. The landfill and associated septage lagoons were in operation from 1938 to 1992. All refuse has since been shipped off Cape to be incinerated at the SEMASS facility in Rochester, MA (Coastal Engineering Co., 1993). The site is not lined and is currently not capped (Coastal Engineering Co., Inc., 1993). Down gradient water samples exhibit elevated conductivity, temperature, ammonium, calcium, iron, magnesium, sodium, vinyl chloride in concentrations of 66.0 to 87.0 ppb, dichloroethane at 76.0 ppb, and other VOC's (Coastal Engineering Co., 1993). The maximum contaminant level (MCL) allowed for drinking water is 2 ppb for vinyl chloride and 5 ppb for dichloroethane (310 CMR Drinking Water, 1997). The contamination plume flows in a southwesterly path toward the Herring River (Figure 7.2c). The Herring River flows into Cape Cod Bay two miles from the landfill. According to Coastal Engineering Co. (1993), who monitors the landfill, existing information on the ground water flow path is insufficiently detailed for any environmental impact assessments to be made.

The Eastham landfill is also currently inactive and unlined, (M. Dakers, 1996, pers. comm., Massachusetts Department of Environmental Protection) but is currently being capped (J. Portnoy, 1997, pers. comm., Cape Cod National Seashore). Down gradient wells to the south and east of the landfill contain landfill leachate parameters with high specific conductance and chemical oxygen demand, as well as petroleum-based VOC's (ATP Environmental, 1995). Ground water flow direction and the extent of contamination was poorly defined in the 1995 ATP Environmental study due to insufficient data; however, regional flow is thought to be generally to the south and southeast, toward National Seashore lands (Figure 7.2d).

The Orleans landfill was in operation from 1949 to 1992 and the septage lagoons were in use from 1949 to 1989. All refuse has since been shipped off Cape to be incinerated at the SEMASS facility in Rochester, Mass. (Coastal Engineering Co., Inc. 1992). The landfill is unlined and has not been capped to date (Coastal Engineering Co., Inc. 1992). The landfill overlies the Monomoy lens of the Cape Cod aquifer which is not associated with National Seashore lands. Ground water at the site, however, has been mapped to flow north towards Town Cove and Nauset Marsh (Coastal Engineering Co., Inc., 1992), surface water bodies partially within the National Seashore.

It is important to note that little research to determine the impacts from these landfills is being conducted. The National Park Service does not actively engage in formalized dialogue with the towns, contracted consultants, or the Massachusetts Department of Environmental Protection regarding impacts from landfills (M. Reynolds, 1996,

pers. comm., Cape Cod National Seashore). Similarly, there are no requirements for the Massachusetts Department of Environmental Protection to discuss the problem with the National Park Service, nor have they voluntarily done so. The Massachusetts Department of Environmental Protection is required to notify the National Seashore if contaminants exceed the state limit in National Seashore drinking water supply wells. (M. Dakers, 1996, pers. comm., Massachusetts Department of Environmental Protection).

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Underground Storage Tanks

In Massachusetts, it is estimated that there are 50,000 underground storage tanks, 20 percent of them leaking each year (Massachusetts Department of Environmental Quality Engineering, 1988). Underground storage tanks are used by many homeowners and commercial businesses on the lower Cape. Each underground tank poses a threat to ground water quality depending on the age and the type of tank (Noake, 1989). The majority of the tanks documented by Barnstable County hold fuel oil and range in size from 250 to 4000 gallons and range in age from 60 years to new (C. Stiefel, 1996, pers. comm., Barnstable County Program Coordinator for Underground Storage Tanks). The towns in Barnstable County each have their own set of regulations for the tanks; Barnstable County keeps a record of their location and inspection

Management Steps: Contamination Sites
400 Days to 5 Years

Committee

Cooperate with towns and the state to determine potential impacts from the landfill plumes. Review the existing contaminant studies specific to the landfills and evaluate the adequacy of testing all relevant contaminants.

Education

Educate residents within the Cape Cod National Seashore boundary that their participation in underground storage tank programs is essential. Develop a survey that is sent to all National Seashore residents asking them the age, type, and purpose of their tanks.

Data Management

Complete a scenario for the next 50 years based on fine resolution ground water models that predicts the locations and impacts of the plumes.

Research

Work to improve descriptions of landfill plumes by using finer resolution ground water models.

documentation. According to Charlotte Stiefel, Program Coordinator for Underground Storage Tanks in Barnstable County, the location of each tank in Barnstable County is currently being entered into a geographic information system database that the Commonwealth of Massachusetts will develop into a data layer.

The Bureau of Waste Site Cleanup in the Massachusetts Department of Environmental Protection maintains a current list of all confirmed and transitional oil and hazardous material disposal sites. The latest standard release report lists spills (releases of two hours) and sites (releases of 120 days) reported since October 1, 1993. In addition to this list, the Department of Environmental Protection maintains a transition list of every "site" in Massachusetts that the agency investigated.

Of the 32 listings for the lower Cape, eight were for underground storage tanks and 15 were for above ground storage tanks; all of these listings were two-hour spills (releases of two hours). Twenty-eight sites are listed on the transition list for the lower Cape. While the source of the contamination is not listed, six of them are confirmed priority sites.

National Park Service Owned Underground Storage Tanks

The latest inventory of underground storage tanks is dated May 3, 1993 and is summarized in Table 7.2. Any changes in status since this date are not reflected in this summary. Actively used underground storage tanks on the National Seashore, with the exception of the four listed in Table 7.2, are constructed with double walled fiberglass and hold gasoline, heating fuel, fuel oil, and diesel. These new tanks range in size from 1,000 to 4,000 gallons.

Table 7.2. Summary of recorded underground storage tanks owned by the National Seashore.

Status	Number	Remarks
Removed	19	Removed in past 10 years
Installed	11	Double walled fiberglass tanks; Less than 10 years old
Unknown	3	NEED building, Ahearn house, and N K Motel
Steel	1	Airport/Camp Wellfleet, Aviation gas